

WHAT IS CLAIMED IS:

1. A semiconductor laser device comprising:

a reflective film constituted of multilayer dielectric films, being provided on at least one side of optical exit
5 faces of a laser chip;

wherein the reflective film includes, in sequence from a side in contact with the laser chip, a first dielectric film of a refractive index n_1 , a second dielectric film of a refractive index n_2 , a third dielectric film of a refractive
10 index n_3 and a fourth dielectric film of a refractive index n_4 , and each of refractive indices satisfies a relation: $n_2 = n_4 < n_1 < n_3$.

2. A semiconductor laser device comprising:

a reflective film constituted of multilayer dielectric
15 films, being provided on at least one side of optical exit faces of a laser chip;

wherein the reflective film includes, in sequence from a side in contact with the laser chip, a first dielectric film of a refractive index n_1 , a second dielectric film of a refractive index n_2 , a third dielectric film of a refractive
20 index n_3 and a fourth dielectric film of a refractive index n_4 , and each of refractive indices satisfies a relation: $n_2 = n_4 < n_3 < n_1$.

3. The semiconductor laser device according to Claim
25 1, wherein each thickness of the first to fourth dielectric

films is set up, in terms of optical length, within $\pm 30\%$ of range of a thickness of an integral multiple of $1/4$ oscillation wavelength.

4. The semiconductor laser device according to Claim 5 2, wherein each thickness of the first to fourth dielectric films is set up, in terms of optical length, within $\pm 30\%$ of range of a thickness of an integral multiple of $1/4$ oscillation wavelength.

5. A semiconductor laser device which emits light of 10 oscillation wavelength λ , comprising:

a reflective film constituted of multilayer dielectric films, being provided on at least one side of optical exit faces of a laser chip;

wherein the reflective film having a reflectance of 3% 15 to 15% includes, in sequence from a side in contact with the laser chip, a first dielectric film of a refractive index n_1 and a thickness d_1 , a second dielectric film of a refractive index n_2 and a thickness d_2 , a third dielectric film of a refractive index n_3 and a thickness d_3 , and a fourth 20 dielectric film of a refractive index n_4 and a thickness d_4 , and

the refractive index n_1 satisfies $1.6 < n_1 \leq 1.9$, the refractive index n_2 satisfies $1.3 \leq n_2 \leq 1.6$, the refractive index n_3 satisfies $1.9 < n_3 \leq 2.3$, and the refractive index 25 n_4 satisfies $1.3 \leq n_4 \leq 1.6$, and

the thickness d_1 is substantially equal to $(2 \cdot h + 1)\lambda / (4 \cdot n_1)$, the thickness d_2 is substantially equal to $(2 \cdot i + 1)\lambda / (4 \cdot n_2)$, the thickness d_3 is substantially equal to $(2 \cdot j + 1)\lambda / (4 \cdot n_3)$, and the thickness d_4 is substantially equal to $(2 \cdot k + 1)\lambda / (4 \cdot n_4)$, wherein each of h , i , j and k is zero or more integer.

6. A semiconductor laser device which emits light of oscillation wavelength λ , comprising:

a reflective film constituted of multilayer dielectric films, being provided on at least one side of optical exit faces of a laser chip;

wherein the reflective film having a reflectance of 3% to 15% includes, in sequence from a side in contact with the laser chip, a first dielectric film of a refractive index n_1 and a thickness d_1 , a second dielectric film of a refractive index n_2 and a thickness d_2 , a third dielectric film of a refractive index n_3 and a thickness d_3 , and a fourth dielectric film of a refractive index n_4 and a thickness d_4 , and

the refractive index n_1 satisfies $1.9 < n_1 \leq 2.3$, the refractive index n_2 satisfies $1.3 \leq n_2 \leq 1.6$, the refractive index n_3 satisfies $1.6 < n_3 \leq 1.9$, and the refractive index n_4 satisfies $1.3 \leq n_4 \leq 1.6$, and

the thickness d_1 is substantially equal to $(2 \cdot h + 1)\lambda / (4 \cdot n_1)$, the thickness d_2 is substantially equal to $(2 \cdot i +$

$1)\lambda/(4*n2)$, the thickness $d3$ is substantially equal to $(2*j + 1)\lambda/(4*n3)$, and the thickness $d4$ is substantially equal to $(2*k + 1)\lambda/(4*n4)$, wherein each of h , i , j and k is zero or more integer.

5 7. The semiconductor laser device according to Claim 1, wherein the first dielectric film is formed of either of Al_2O_3 , CeF_3 , NdF_3 , MgO and Y_2O_3 , the second and fourth dielectric films are formed of either of SiO_2 , MgF_2 , BaF_2 and CaF_2 , and the third dielectric film is formed of either of
10 Ta_2O_5 , SiO , ZrO_2 , ZnO , TiO , TiO_2 , ZnS , Nb_2O_5 , HfO_2 and AlN .

8. The semiconductor laser device according to Claim 5, wherein the first dielectric film is formed of either of Al_2O_3 , CeF_3 , NdF_3 , MgO and Y_2O_3 , the second and fourth dielectric films are formed of either of SiO_2 , MgF_2 , BaF_2 and
15 CaF_2 , and the third dielectric film is formed of either of Ta_2O_5 , SiO , ZrO_2 , ZnO , TiO , TiO_2 , ZnS , Nb_2O_5 , HfO_2 and AlN .

9. The semiconductor laser device according to Claim 2, wherein the first dielectric film is formed of either of Ta_2O_5 , SiO , ZrO_2 , ZnO , TiO , TiO_2 , ZnS , Nb_2O_5 , HfO_2 and AlN , the
20 second and fourth dielectric films are formed of either of SiO_2 , MgF_2 , BaF_2 and CaF_2 , and the third dielectric film is formed of either of Al_2O_3 , CeF_3 , NdF_3 , MgO and Y_2O_3 .

10. The semiconductor laser device according to Claim 6, wherein the first dielectric film is formed of either of
25 Ta_2O_5 , SiO , ZrO_2 , ZnO , TiO , TiO_2 , ZnS , Nb_2O_5 , HfO_2 and AlN , the

second and fourth dielectric films are formed of either of SiO_2 , MgF_2 , BaF_2 and CaF_2 , and the third dielectric film is formed of either of Al_2O_3 , CeF_3 , NdF_3 , MgO and Y_2O_3 .

11. The semiconductor laser device according to Claim
5 1, wherein a multilayer dielectric film in combination with a fifth dielectric film and a sixth dielectric film is additionally formed in a region other than a light emitting point on the optical exit faces of the laser chip, and a reflectance of the region other than the light emitting point
10 is smaller than a reflectance of the region of the light emitting point.

12. The semiconductor laser device according to Claim
2, wherein a multilayer dielectric film in combination with a fifth dielectric film and a sixth dielectric film is
15 additionally formed in a region other than a light emitting point on the optical exit faces of the laser chip, and a reflectance of the region other than the light emitting point is smaller than a reflectance of the region of the light emitting point.

20 13. The semiconductor laser device according to Claim 11, wherein each thickness of the fifth and sixth dielectric films is set up, in terms of optical length, within $\pm 30\%$ of range of a thickness of an integral multiple of $1/4$ oscillation wavelength.

25 14. The semiconductor laser device according to Claim

12, wherein each thickness of the fifth and sixth dielectric films is set up, in terms of optical length, within $\pm 30\%$ of range of a thickness of an integral multiple of $1/4$ oscillation wavelength.

5 15. The semiconductor laser device according to Claim 13, wherein the fifth dielectric film is formed of either of Al_2O_3 , CeF_3 , NdF_3 , MgO and Y_2O_3 , and the sixth dielectric film is formed of either of SiO_2 , MgF_2 , BaF_2 and CaF_2 .

10 16. The semiconductor laser device according to Claim 14, wherein the fifth dielectric film is formed of either of Al_2O_3 , CeF_3 , NdF_3 , MgO and Y_2O_3 , and the sixth dielectric film is formed of either of SiO_2 , MgF_2 , BaF_2 and CaF_2 .

15 17. The semiconductor laser device according to Claim 1, wherein the laser chip has a plurality of light emitting points which emit two or more different oscillation wavelengths.

20 18. The semiconductor laser device according to Claim 2, wherein the laser chip has a plurality of light emitting points which emit two or more different oscillation wavelengths.

25 19. The semiconductor laser device according to Claim 1, wherein two or more of the semiconductor laser devices are arranged in a single package, and each of laser chip emits different oscillation wavelength from each other, and each of multilayer dielectric film on the optical exit face of each

laser chip is formed of the same material with the same thickness.

20. The semiconductor laser device according to Claim 2, wherein two or more of the semiconductor laser devices are
5 arranged in a single package, and each of laser chip emits different oscillation wavelength from each other, and each of multilayer dielectric film on the optical exit face of each laser chip is formed of the same material with the same thickness.